CHARLES DARWIN UNIVERSITY

Family Name	
Given Names	
Student Number	
Teaching Period	Semester 1, 2017

FINAL EXAMINATION	**DURATION**
ECM262 – Teaching the Curriculum: Maths 2	Reading Time: **10** minutes Writing Time: **120** minutes

INSTRUCTIONS TO CANDIDATES

There are three sections to this exam. You need to answer all three.

- **Section A** is of 29 marks, this section deals with your basic and senior mathematics content Knowledge.
- **Section B** is of 14 Marks, it deals with writing model solutions. You need to answer any two out of the four questions in this section.
- **Section C** is of 28 marks, this section is concerned with your pedagogical content knowledge and assessment of students' work.

Please note that under the authorised materials, Lecture Text books include any Senior Maths Text Book.

EXAM CONDITIONS

This is a RESTRICTED OPEN BOOK examination

Any calculator is permitted

One A4 sheet of handwritten double-sided notes permitted

Any hard copy, unannotated dictionary is permitted

Answer on both exam paper and supplied material/s

ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED
Lecture Textbook/s (Unannotated) Lecture Notes (Unannotated)	1 x 8 Page Book 1 x Scrap Paper Graph Paper

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

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Section B
Short Answer Questions
(Writing model solutions)

Marks for each question are indicated.
Suggested Time allocation for Section B: 25 minutes
Total No of Marks for this section: 14

Write model solutions for **any two** of the following four questions **in this section**, assuming these be given to the students to emphasize the importance of communicating mathematically when presenting their solutions

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Question 1

Find $\frac{dy}{dx}$ for each of the following functions. There is no need to simplify your answers.

(a) $y = (x^2 - \frac{4}{x})^3$

Formula

Step 1

Step 2

Answer

(3 marks)

(b) $y = \frac{\ln x}{1 - e^{-x}}$

Formula

Step 1

Step 2

Answer

(4 marks)

Question 2

Consider $D = \begin{bmatrix} 2 & k & k^2 \\ 0 & -1 & k \\ -2 & 1 & 0 \end{bmatrix}$

(a) Evaluate the determinant of D

Formula

Step 1

Step 2

Answer

(4 marks)

(b) Hence determine the value(s) of k for which the matrix D has no inverse.

Explanation:

When does a matrix not have an inverse?

Step 1

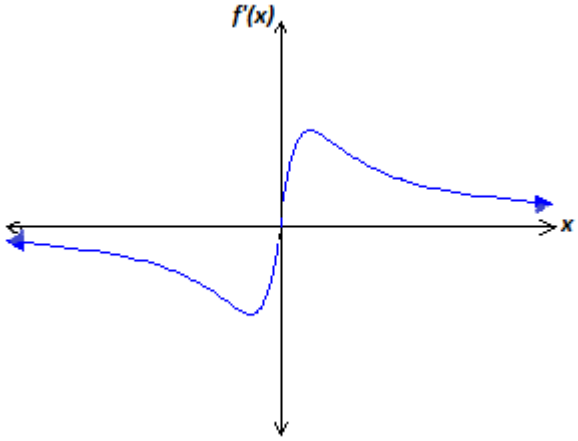
Step 2

Answer

(3 marks)

Question 3

The graph of the **derivative** $y = f'(x)$ is shown below:



(a) The graph passes through the origin *O*. What does this tell you about the graph of $y = f(x)$

Explanation:
Values of the (x,y) at origin; what does it mean in relation to the above graph
How it relates to y= f(x)

(3 marks)

(b) On the graph above, mark and label any points where (second derivative) $f''(x) = 0$ What do these points tell you about the graph of $y = f(x)$

Explanation:
What is the connection between the key points on the graph and the derivative?

(4 marks)

Question 4

Consider the 'curve' $xy^2 - 2y - x^2 = 0$, where x and y are real numbers.

(a) Show that $\frac{dy}{dx} = \frac{2x - y^2}{2xy - 2}$

Formula
Derivative of implicit functions

Step 1

Step 2

Answer

(3 marks)

(b) Show algebraically that there are 2 points on the curve where $x = 2$. State the coordinates of each point, and find the slope of the curve at each point.

What happens *at x=2 Substitution in the equation*

Solving *the equation*

Writing *coordinates of points*

Connection *of dy/dx and slope*

Finding *the slopes*

(4 marks)

Section C
Create a response Questions
(Pedagogical knowledge and assessment of students' work)

Marks for each question are indicated.
Suggested Time allocation for Section C: 45 minutes
Total No of Marks for this section: 28

This section is about answering students' queries, assessing their work and providing suitable feedback to them.

Question 1

You have finished teaching a specific unit and are about to begin teaching the topic of Calculus. How would you initiate, engage and motivate the study of this topic in your class?

(4 marks)

Question 2

a) A student asks you the meaning of Integral (as in Integral calculus), what does it calculate? How would you respond?

b) Another student asks you why-we need to memorize 'Times tables' in the age of calculators, mobile phones and other hand held electronic devices, when a push of a few buttons can give us the answer? How would you respond?

(3+3 marks)

Question 3

A student was given the task of solving the following equation

$$x^2 + 8x + 15 = 3$$

The student proceeded with

$$x^2 + 8x + 15 = (x+3)(x+5)$$

Thus

$$(x+3)(x+5) = 3$$

Thus either

$$(x+3) = 3 \text{ and } (x+5) = 1$$

$$\text{And hence } x = 0 \text{ or } -4$$

or $(x+3) = 1$ *and* $(x+5) = 3$ *which mean* $x = -2$

Thus the solutions are $x = -2, 0$ *or* -4

What is wrong with the solution and how would you explain the fallacy?

(5 marks)

Question 4

In an exam the following question was given:

Solve $x^2 = 7x$

Two students produce the subsequent pieces of working in response to the above question.

Student A	***Student B***
Divide both sides by x: $\frac{x^2}{x} = \frac{7x}{x}$ *Canceling common factors on each side of the equation:* $x = 7$ *Check: substituting x =7 into the equation shows it's a solution.*	*Subtract 7x from both sides:* $x^2 - 7x = 7x - 7x$ *thus* $x^2 - 7x = 0$ *Factorizing:* $x(x - 7) = 0$ *Thus using null factor law :* $x = 0$ *or* $x = 7$

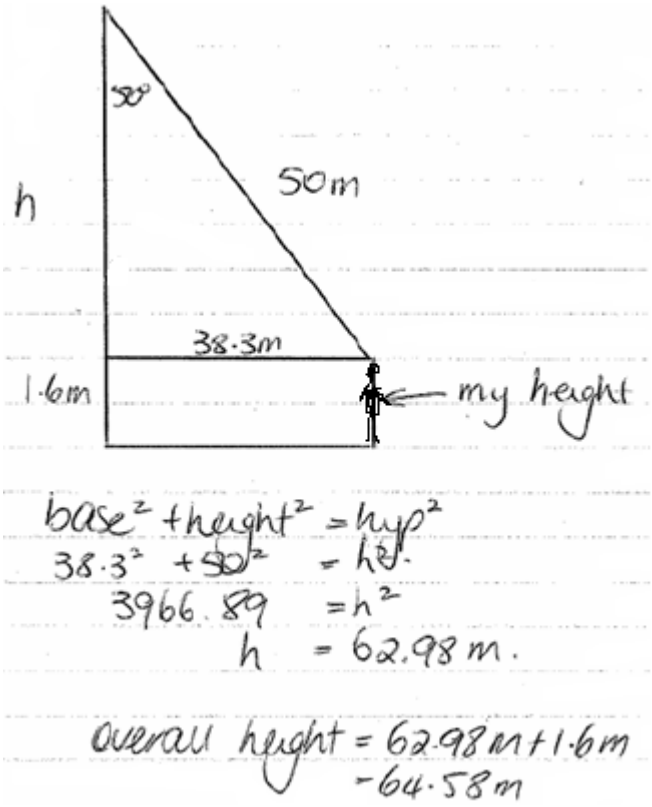
Clearly one solution is not 'complete'. How would you explain this to the concerned student with a focus on what conceptual misunderstanding the student might be having?

(5 marks)

Question 5

Fred has purchased himself a box kite so he can participate in the Bachelor Bay Kite Festival. The packaging on the kite states that the kite string will form an angle of 50° to the vertical when the kite is flying and the string is tight.
Fred wonders how high the kite will fly when he uses 50 meters of kite string. At noon, when the sun is directly overhead, Fred gets his friend Barlow to measure the distance along the ground between himself and the shadow of the kite.
Fred constructs the following diagram and uses Pythagoras Theorem, as shown, to find the height of the kite.

Image source: https://au.pinterest.com/roberts0162/flight-kites/



a. Explain to Fred why the height of the kite that Fred calculated is unrealistic.

(2 marks)

b. Make the appropriate corrections to Fred's working to find the correct height of the kite.

(2 marks)

c. Show Fred another method to find the height of the kite.

(4 marks)

Extra Space if needed